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TROPOSPHERIC RANGE ERROR CORRECTIONS FOR THE GLOBAL POSITIONING SYSTEM IN SRI LANKA

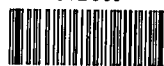


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Electronic & Telecommunication Engineering

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The work presented in this dissertation has not been submitted for the fulfillment of any other degree



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ABSTRACT

The Global Positioning System is the most accurate positioning and navigation system in use today. It uses the time of arrival of radio signals transmitted from satellites placed in high altitude orbits around the globe.

The ideal GPS theory assumes free space radio propagation whereas in reality, the signals have to propagate through the atmosphere. When propagating through the atmosphere, the finite refractive index of the various layers of the atmosphere causes the electromagnetic waves to travel distances that are longer than the corresponding free space distances. This causes an error in the observed time of arrival which is carried on to the positional computation.

The error due to refraction in the troposphere is of particular interest. Unlike the ionosphere, the troposphere is non-dispersive. Its refractive properties depend more on physical parameters such as pressure and temperature. Due to this reason, the refractivity tends to depend on the location as well. It has been shown that a good correlation exists between the refractivity at the surface of the earth and the range error. Hence this error may be determined using the refractivity at the surface of the earth.

In this dissertation, the effect of the troposphere on GPS observations made within the geographical extent of Sri Lanka is studied. The range errors at reference locations within Sri Lanka are determined for different parts of the year. The results are compared with established results for the region and reasons for discrepancies are briefly discussed.

The design of a conceptual GPS receiver processor that can self-correct tropospheric range errors at the surface of the earth by sensing the pressure and the temperature is proposed. A computer program is used to simulate the operation of this receiver.

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LIST OF ABBREVIATIONS USED

| | |
|-------------|---------------------------------|
| CEP | Circular Error Probable |
| DRMS | RMS Radial Distance Error |
| GDOP | Geometric dilution of precision |
| GPS | Global Positioning System |
| PDOP | Position dilution of precision |
| SA | Selective Availability |
| SEP | Spherical Error Probable |
| TDOP | Time dilution of precision |
| TOA | Time of Arrival |
| UERE | User Equivalent Range Error |
| UTC | Universal Time Transfer |



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